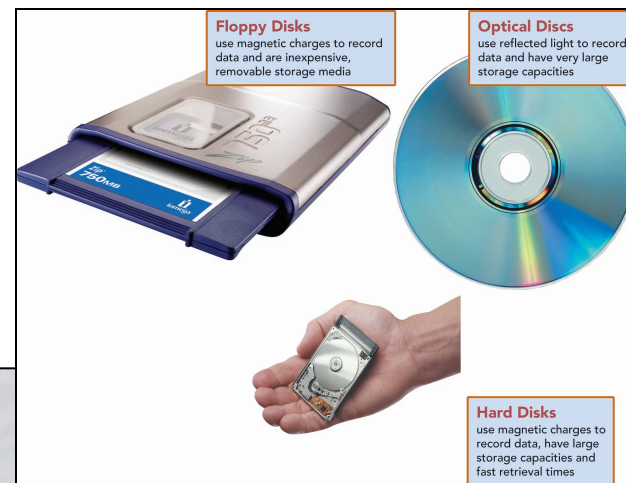# Chapter 8

Secondary Storage
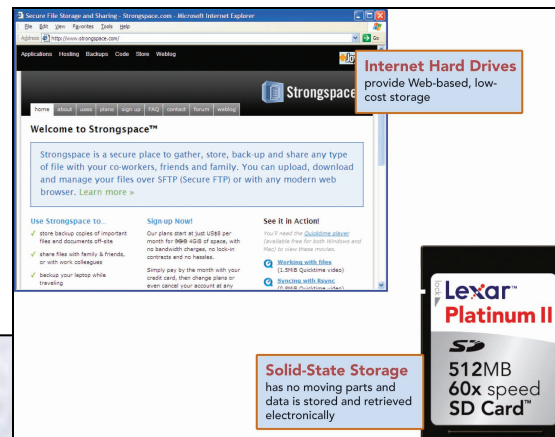
Competencies

- **Distinguish between primary and secondary storage**

- **Describe the traditional floppy disk and compare it to high capacity floppy disks**

- **Compare internal hard disks, hard-disk cartridges, and hard-disk packs**

Floppy Disks
use magnetic charges to record data and are inexpensive, removable storage media

Optical Discs
use reflected light to record data and have very large storage capacities

Hard Disks
use magnetic charges to record data, have large storage capacities and fast retrieval times

8-2

Competencies

- **Describe ways to improve hard-disk operations, including disk caching, redundant arrays of inexpensive disks, and data compression and decompression**

- **Discuss the different types of optical disks**

- **Describe solid-state storage, Internet drives, and magnetic tape**

- **Discuss mass storage and mass storage devices**

Internet Hard Drives provide Web-based, low-cost storage

Solid-State Storage has no moving parts and data is stored and retrieved electronically

8-3

Introduction

Data storage has expanded from text and numeric files to include digital music files, photographic files, video files, and much more.

These new types of files require secondary storage devices with much greater capacity than floppy disks.

In this chapter, you will learn about the many types of secondary storage devices including their capabilities and limitations.
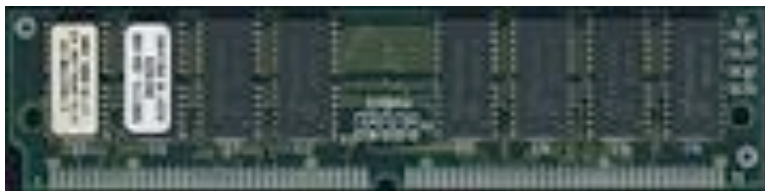
Storage

Primary storage

"Main Memory"
– Volatile storage
– Temporary storage

Secondary storage

– Nonvolatile storage
– Permanent storage

Characteristics

– Media
– Capacity
– Storage devices
– Access speed

Terminology

- **<u>Reading</u>**
  - **The process of accessing information from secondary storage**
  - **"Getting" the data from disk**
  - **Opening a file → reading!**
- **<u>Writing</u>**
  - **The process of saving information to the secondary storage device**
  - **"Storing" data on the disk**
  - **Saving a file → writing!**

Secondary Storage Devices

- **Most desktop microcomputer systems have:**

floppy disks,   **hard disks,**   **or**   **optical disk drives**

Secondary Storage Devices

- **Most desktop microcomputer systems have:**

floppy disks,   **hard disks,**   **or**   **optical disk drives**

Inexpensive, Removable

Secondary Storage Devices

- **Most desktop microcomputer systems have:**

floppy disks,   **hard disks,**   **or**   **optical disk drives**

Large storage capacity, fast access time

8-9

Secondary Storage Devices

- **Most desktop microcomputer systems have:**

floppy disks,   hard disks,   or   optical disk drives

Large storage capacity, durable and inexpensive

Secondary Storage Devices

- **Uses:**
  - **Save important data (files)**
  - **Backup data**
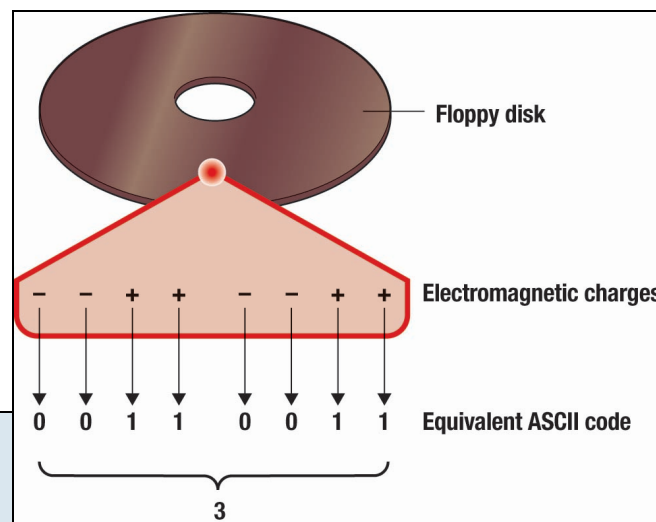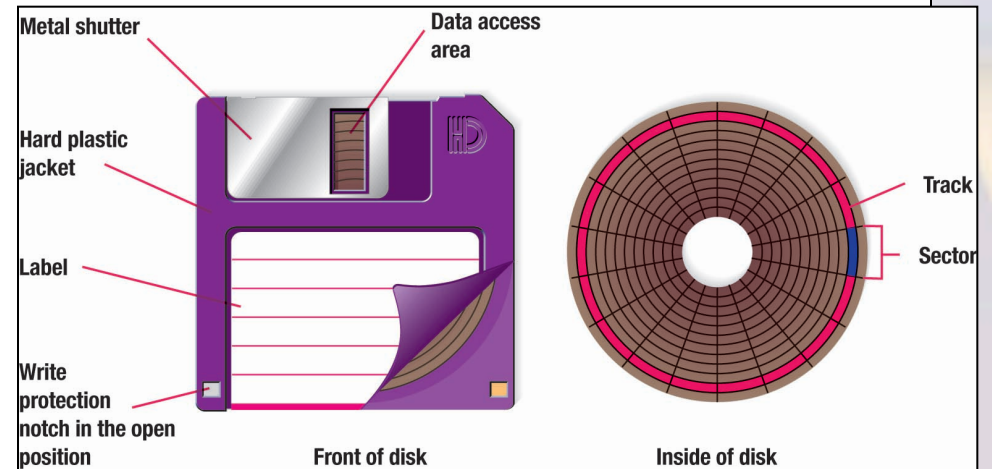 - **Transport data and programs**

Floppy Disks

- **Portable or removable storage media**
- **Typically used to store and transfer small word processing, spreadsheet, and other types of files**
- **Floppy disk drives (FDD)**
  - **Store data and programs**
  - **Retrieves data by reading electromagnetic charges**
  - **Also called flexible disks and floppies**

8-12

Traditional Floppy Disk

- **Most common type is 2HD "two-sided, high-density"**
- **Attributes**
  - **Shutter**
  - **Labels**
  - **Write-protection notch**
  - **Tracks**
  - **Sectors**

Metal shutter — Data access area — Hard plastic jacket — Label — Write protection notch in the open position — Front of disk — Track — Sector — Inside of disk

Floppy disk — Electromagnetic charges — Equivalent ASCII code

−	−	+	+	−	−	+	+
0	0	1	1	0	0	1	1

3

High Capacity Floppy Disks

- **Known as a floppy-disk cartridge**

- **Require special disk drives**

- **Most widely used is the Zip disk (IOmega)**
  - **100 MB, 250 MB or 750 MB capacity**
 - **Used to store multimedia, database, large text, and spreadsheet files**

8-14

Hard Disks

- **Use thicker, metallic platters for storage**

- **Faster than a floppy diskette**

- **Large capacity**

- **Sensitive instruments**

- **There are three types of hard disks:**
  - **Internal Hard Disk**
  - **Hard-disk cartridge**
  - **Hard-disk pack**

- **Performance Enhancements**

Materials that Cause
a "Head Crash"

- **Head crash** is a disaster for a hard disk

  (Hard disk unit is completely sealed)

Disk head

Human hair

Dust particle
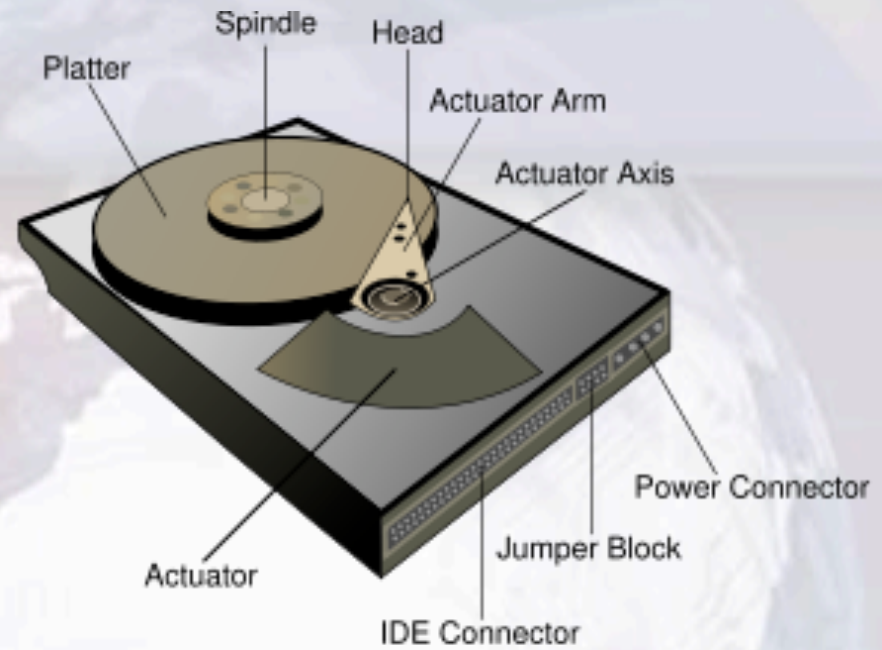
Fingerprint

Smoke particle

So Backup!

8-16
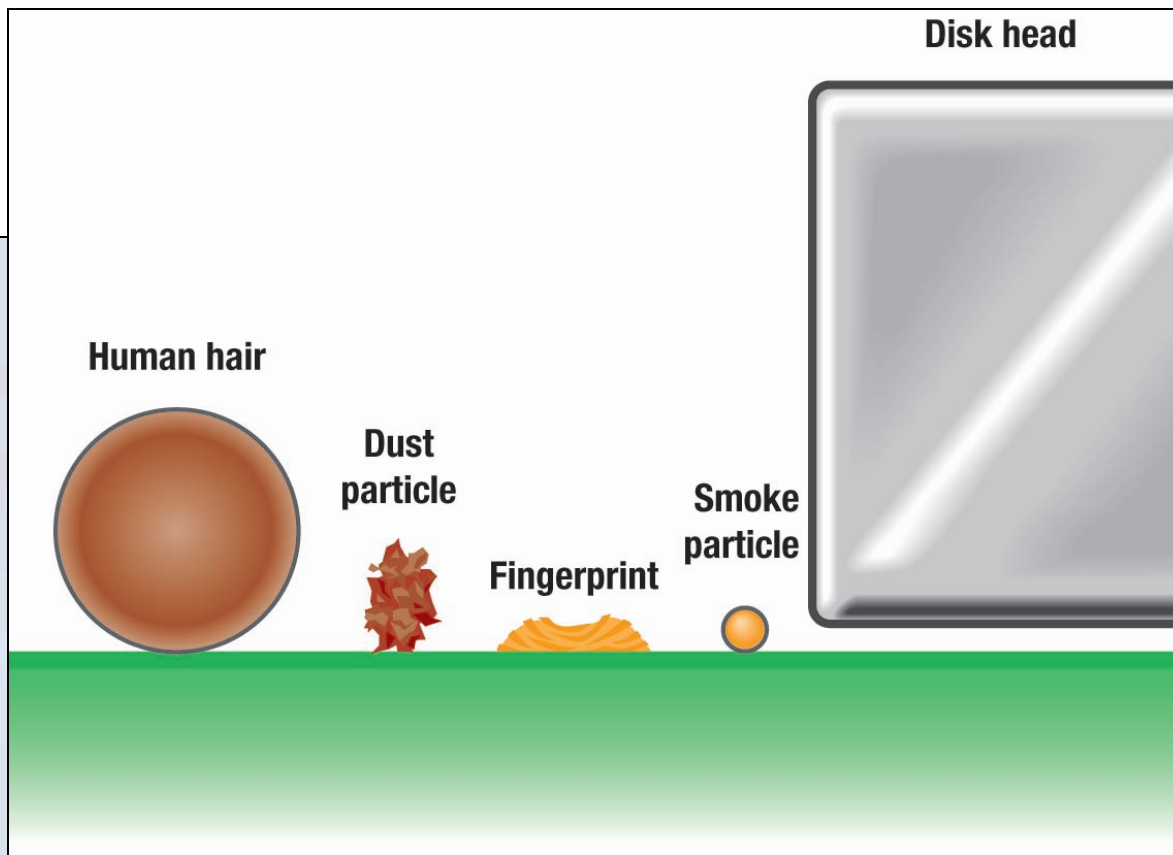
Internal Hard Disk

- **Located inside system unit**

- **Designated as the C: drive**

- **Advantages over floppies**

  - **Capacity**

  - **Access speed**

Internal Hard-Disk

Platter — Spindle — Head — Actuator Arm — Actuator Axis — Power Connector — Jumper Block — IDE Connector — Actuator

Hard-Disk Cartridges

- **Removable hard disks**

- **Used to complement internal hard disk**

- **Capacities of 20 to 100 GB**

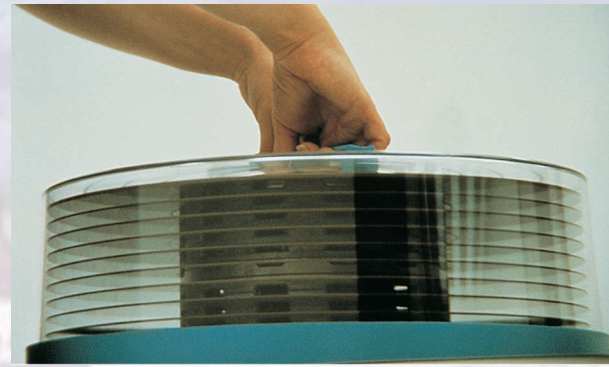- **Iomega is one of the most widely used**

Hard-disk cartridge

PC Card Hard Disks

8-19

Hard-Disk Packs

- **Removable hard disk**

- **Massive storage capacity**

- **Common in mainframes**

- **Are utilized by banks and credit card companies**

Type	Description
Internal	Fast access to applications, fixed
Cartridge	Complement to internal hard disk, removable
Disk pack	Massive storage capacity, removable

Access arm slides in and out to specific track   Read/write heads
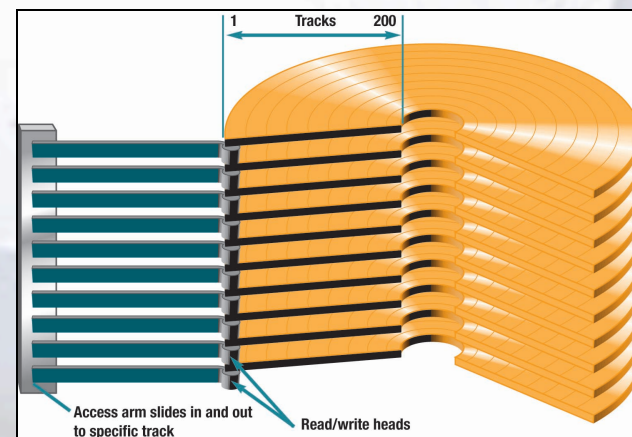
Performance Enhancements

- **Disk caching**

- **Redundant arrays of inexpensive disks (RAID)**

- **File compression** and **decompression**

Technique	Description
Disk caching	Uses cache and anticipates data needs
RAID	Linked, inexpensive hard-disk drives
File compression	Reduces file size
File decompression	Expands compressed files

8-21

RAID

Redundant Arrays of Inexpensive Disks

- A group of low cost hard-disk drives
- All connected together to act as one disk

  (Specialized Hardware, Software, OS)

- Performs as a single large-capacity disk
- Faster than a single disk of comparable size
- Often used by

  Internet servers and large organizations

- Increased **reliability** is provided

Optical Disks

- **Hold over 50 gigabytes of data**

- **Attributes**
  - **Lands**
  - **Pits**

- **Three types**
  - **Compact Disc (CD)**
  - **Digital Versatile Disc (DVD)**
  - **Hi-Def Disc**

Compact Disc

- **Optical format**
- **From 650 MB to 1 GB capacity**
- **Rotation speeds vary**
- **Three basic types**
  - **Read only**: **CD-ROM**
  - **Write once**: **CD-R**
  - **Rewriteable**: **CD-RW**

Digital Versatile Disc

- **Digital Versatile Disc or Digital Video Disc (DVD)**

- **Similar to CDs, but can store more data**

- **Three basic types**
  - **Read only: DVD-ROM**
  - **Write once: DVD+R; DVD-R**
  - Rewritable: **DVD+RW; DVD-RW; DVD-RAM**

High-Definition Disc

- **Next generation of optical disc**
- **Far greater capacity than DVDs**
- **Three basic types**
  - **Read only**
  - **Write once**
  - **Rewriteable**

Format	Typical Capacity	Description
CD	650 MB to 1 GB	Once the standard optical disc
DVD	4.7 GB to 17 GB	Current standard
HD DVD	15 GB to 45 GB	Hi-def format, similar to DVD
Blu-Ray	25 GB to 50 GB	Hi-def format, large capacity

- **Two competing hi def formats**
  - **HD DVD**
  - **Blu-Ray**

High-Definition DVD
The Hi-Def Optical Disk Format War

- **HD DVD**
  - **15 GB (30GB dual layer)**
  - **Now obsolete**

- **Blu-ray**
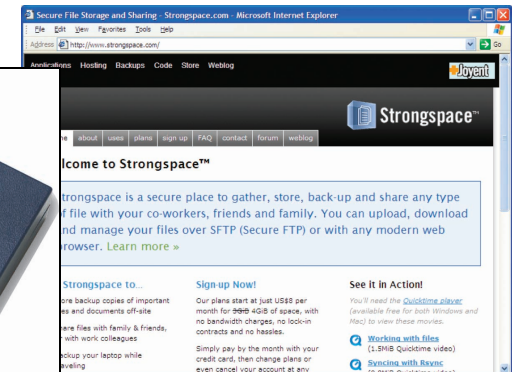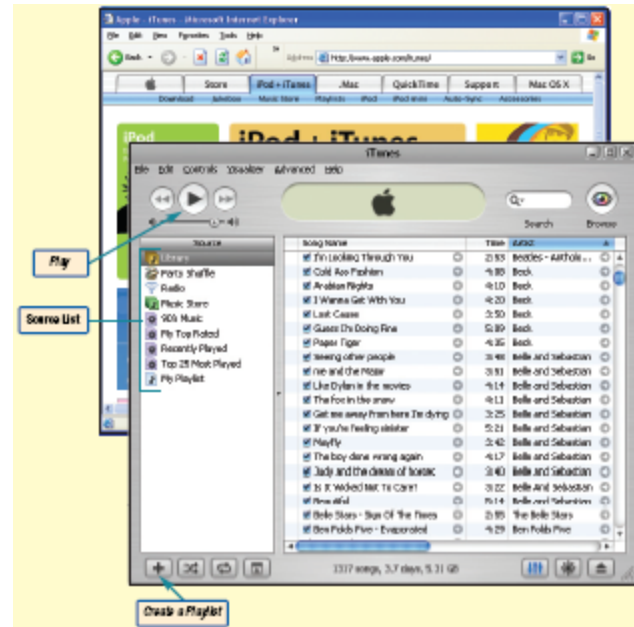
  25 GB (50GB dual layer)

8-27

Other Types of Secondary Storage

- **Solid-state storage**

- **Internet hard drives**

- **Magnetic tape**

iPods and Music From The Internet

- **The Internet can be used as a medium to locate and play music**

- **A user can create compact discs, or transfer music to a portable player**

- **Requirements**
  - **Software**
  - **Hardware**
  - **Internet**

Solid-State Storage

- **Flash memory cards**
  - Widely used in notebook computers
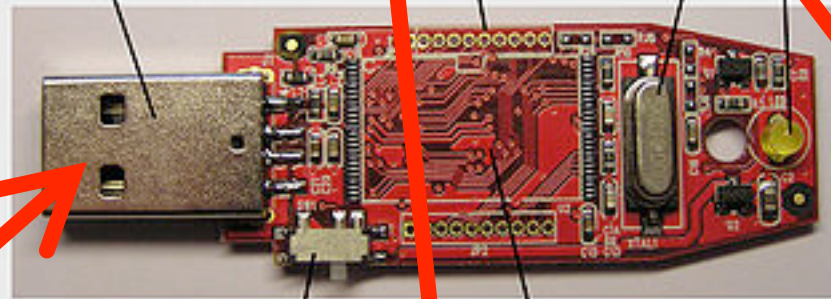 - Used to record MP3 music files

  Flash memory card

- **USB Flash Drives ("Thumb Drives")**
  - Key ring flash memory devices or flash drives
  - Connects to a USB port
  - Up to 2GB

  Key ring flash memory

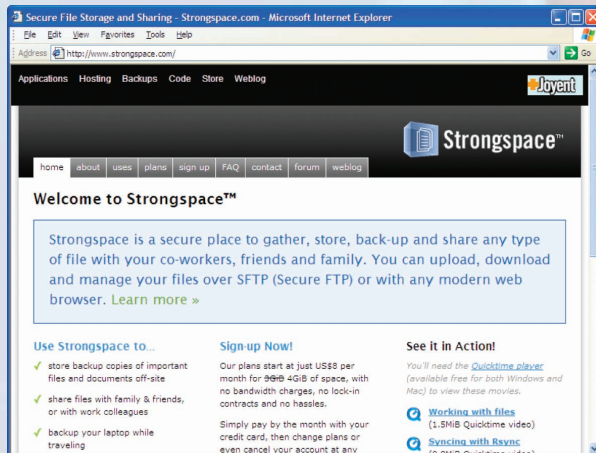# Inside a USB Flash Drive

"Thumb Drive"

USB connector

Microcontroller chip

Flash memory chip

Internet Hard Drives

- **Known as i-drive or online storage**
- **Low cost and can access information from any location using the Internet**
- **Oriented to either businesses or individuals**

| Focus	Company	Location
Individual	iBackup	www.ibackup.com
Individual	xDrive	www.xdrive.com
Business	Amerivault	www.amerivault.com
Business	Iron Mountain Digital	www.ironmountain.com

Magnetic Tape

- **External storage**

- **Provides sequential access**
  - **Information stored in sequence**
  - **Slower than disks which provide direct access**

- **Magnetic tape streamers or tape cartridges used by both mainframes and microcomputers**

Mass Storage Devices

- **Mass storage refers to the tremendous amount of secondary storage required by large organizations**

- **Mass storage devices are specialized high-capacity secondary storage devices**

- **Enterprise storage system promotes efficient and safe use of data across networks within organizations**


8-34
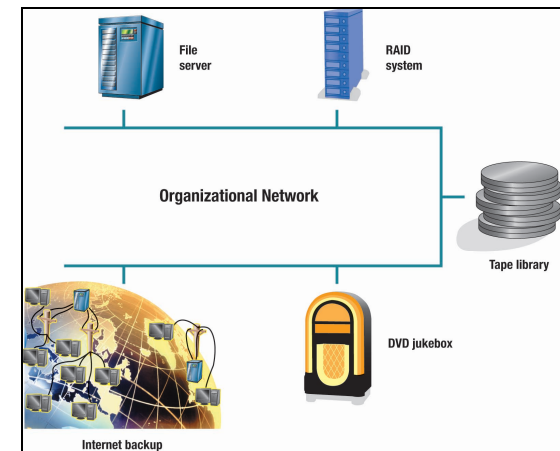
Careers In IT

- **Software engineers** analyze users' needs and create application software

- General employer requirements
  - Bachelors degree in computer science
  - Extensive knowledge of computers and technology
  - Good communication and analytical skills

- Software engineers can expect to earn an annual salary of $53K to $88K

A Look to the Future

Your Entire Life Recorded on a Single Disk

- **Future secondary storage disks could eventually store one terabyte**

- **Experiments with three dimensional storing**

- **Video of an entire life**

- **Technology is being used to rapidly scan photos and videos**
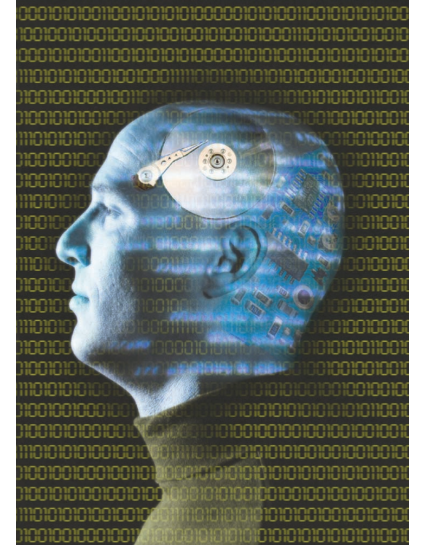
Discussion Questions

- **Discuss the traditional and high-capacity floppy disks.**

- **What are the three types of hard disks? Describe three ways to improve hard disk performance.**

- **What are the two most common optical disk formats? What is hi def? Describe the basic types for each format.**

Discussion Questions

- **Discuss solid-state storage, Internet hard drives, and magnetic tape. What are the advantages and disadvantages of each?**

- **Discuss mass storage, enterprise storage systems, and mass storage devices.**